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ECOLOGICAL RESEARCH ON THE *PARECTOPA ROBINIELLA* POPULATION

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Abstract
This article presents an ecological research carried out during 8 years on the population of Parectopa robiniella living in the Northern area of the Arges county inhabited by black locusts. This article presents information regarding the type of distribution, variation, density, the effects of the attacks, the effects of parasitoids, correlations between the dynamics of the population and climatic factors. Besides the species we studied on black locust leaves, we also identified the Phyllonorycter robiniella and Obolodiplosis robiniae species which allowed us to calculate the niche overlap.

Keywords: climatic factors, parasitoids, Parectopa robiniella, population dynamics.

1. INTRODUCTION

The research on this pest insect was conducted in the hills of Arges county, in the forest range of Domnesti and started in 2008. The black locust trees inhabit beech forests. *Parectopa robiniella* is a multivoltine species of the lepidoptera order, which undergoes complete metamorphosis, whose larvae mine the black locust leaves. It is native to North America and it was first recorded in Europe in 1970 (Vidano, 1971), and in Romania in 1990 (Nețoiu, 1990). The purpose of the researches conducted was to describe the life cycle (Csóka, 1999; Nețoiu, 2003), the ecological effects on black locust trees (Nețoiu and Toma, 2006), the effects of parasites on this species (Csóka et al., 2009). The size of the adult is rather small (5mm) with a wingspan of 8 mm. The colourless egg is laid on the under side of the black locust leaflet, close to the main stem. The larva, white at first, becomes yellow-green and feeds on the mesophyll of the leaf. The mature larva gets out of the mine by going down on a silk thread until reaching the dead leaves on the ground where it forms a white cocoon. In the area we conducted our research we noticed that the moth had two generations.

2. MATERIALS AND METHODS

Parectopa robiniella was identified on the edge of the forest, as well as on the trees on the hill (2008-2015). On the hill, where there are massive trees, the presence of the two generations has been recorded since 2009. On the forest edge, we delimited an area of 100 m^2. The trees on this surface are of various classes and ages. The branches were collected randomly from the lower third of the crown and the individuals from the first 5 leaves were counted starting from the top of the

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branches. Samples were collected every week. In order to process the data from a statistical point of view we used the T-test, the ANOVA test, linear regression and Pianka's index. For the purpose of identifying the existance of parasitoids on *Parectopa robiniella* we collected damaged leaves that were stored into plastic boxes. Besides *Parectopa robiniella* two more specied were identified, pertaining to the *Sympiesis* and *Minotetrastichus* genus.

3. RESULTS AND DISCUSSIONS

The identification has been made by directly observing the leaves and mines. In order to establish the type of distribution we used data obtained at the beginning of July and we concluded that the distribution is grouped. By monitoring the trees in the sample areas we found that 30% to 50% of the marked trees were attacked by the first generation, while the percentage attacked by the second generation was of 100%. In the first generation there are 1-2 individuals per damaged leaf, while in the 2nd generation their number varies between 1 and 20 individuals.
The data collected on the field allowed us to make a comparison between the average numbers of individuals per leaf in different generations, as well as in different years (figure1).

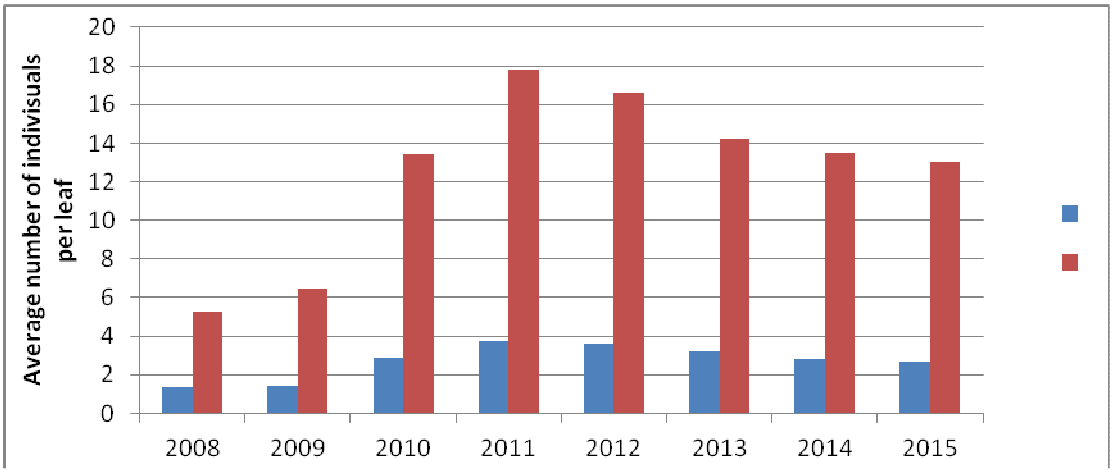

Figure1. The Evolution in numbers of individuals of the Parectopa robiniella population (first generation, second generation)

Starting from this data we used the one-way ANOVA test and the result of this test revealed that there is no resemblance between the average numbers of individuals of different generations in the same year. By using the two-way ANOVA with replication we concluded that there might be similarities beetween the population generations of different years. To obtain a forecast we established that there is a correlatio between the two generations. The multiplication factor has different annual values varying between 3,8 and 4,8. Through regression analysis we can estimate the average of the second generation when we have a value for the associated variable (the average of the first generation). Regression analysis (fig.2) determines if the two variables are associated and to which degree.

Considering that R^2 is of 98% we can assert that there is a very strong connection between the 2 variables and we can forecast the number of individuals of the 2nd generation.
The researches conducted in Europe (Stojanović and Marković, 2005; Ureche, 2006; Csóka et al., 2009; Retevoi, 2012) highlighted the existence of 23 species of primary and secondary parasitoids

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of the *Parectopa robiniella* with a parasitation rate of 50%. Since 2010, besides the *Parectopa robiniella*, 2 species of parasitoids have been identified, pertaining to the *Sympiesis* and *Minotetrastichus* genus and having a different parasitation rate every year (figure 3).

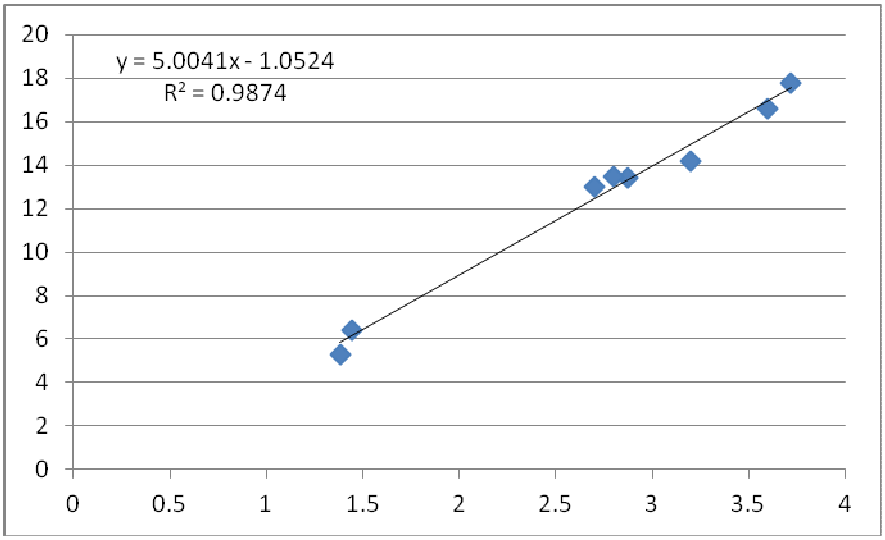

Figure 2. Regression analysis

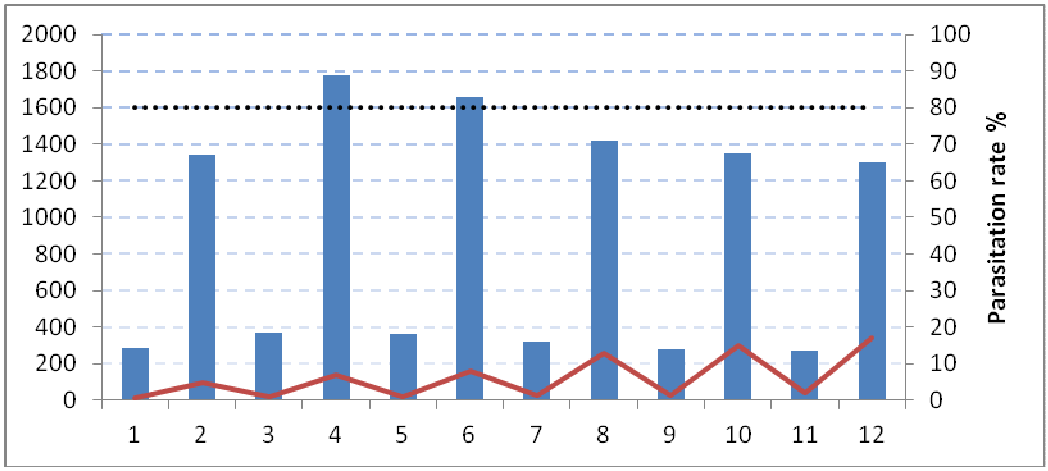

Figure 3. The parasitation rate of Parectopa robiniella 2010-2015

If at first the parasitation rate was of 0,5% we can see a gradual increase of this number until reaching 17%. Parasitoids caused a decrease in the number of individuals to such extent that the population reached figures similar to the ones recorded in 2010. Starting from the average temperatures per decade from 2008 and 2009 we could observe a moderate negative correlation, while in 2009 there is no correlation whatsoever (figure 4).

In order to calculate the niche overlap we used Pianka's index (1973). *Parectopa robiniella Phyllonorycter robiniella* and *Obolodiplosis robiniae* are monophagous species. We considered that every leaf was a new source of food and the data was entered in the EcoSim software. In 2009 the

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index was of 0,02 but the *Obolodiplosis robiniae* species was not part of the ecosystem. By repeating the test in 2015 the value of the index was of 0.35.

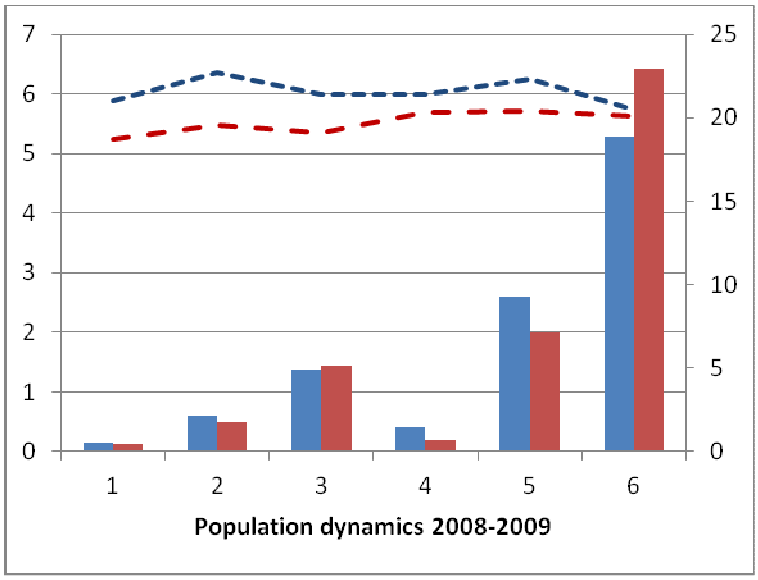

Figure 4. Correlations between the statistical evolution of the Parectopa robiniella population and temperature

The degree of leaf damage (%) varies from the forest edge to the hill. However the average degree in time is of 47% for the forest edge and 12% for the hill.

The research conducted by Maceljski & Mešić (2001), has shown a correlation between the intensity of the attack, the blooming season and the number of flowers. It is difficult to make such a correlation because the adequte temperature and water intake for buiding up sugar reserves that sustain the development of flower buds are different every year. The late season frosts from the past several years have delayed the blooming season with 10 to 12 days, have decreased the number of flowers and caused the production of less nectar.

4. CONCLUSIONS

Parectopa robiniella is an invasive species inhabiting the black locust trees from Arges. By monitoring the trees in the sample areas we found that 30% to 50% of the trees were attacked by the first generation, while the percentage attacked by the second generation was of 100%. As far as the first generation is concerned, on the damaged leaves we counted 1-2 individuals, while in the second generation the number of individuals varies between 1 and 20. Through regression analysis we could estimate the average for the second generation using the following formula: $y = 5.0041x - 1.0524$. The parasitation rate has increased from 0,5% to 17%. The parasitoids have determined the decline of the population which reached values similar to the ones recorded in 2010. The correlation between the dynamics of the population and temperature averages is either slightly negative or it does not exist. Pianka's index (1973) used to determine the niche overlap has incresed by 17,5 times. Climatic factors, as well as the attacks of invasive species have led to a delay of the blooming season, have decresed the number of flowers and caused the production of less nectar.

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